Improvements in rules and regulations to support sensemaking in safety-critical maritime operations

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Introduction

Background and scope:

- Challenges in complex maritime operations
- Risk i.e. occurrences of serious accidents has increased (30%)
- Focus on critical bridge operations: **how the mariners sensemaking** are supported

Issues and research questions:

- Is poor design of bridge systems a contributor to accidents?
- Causes of accidents involving bridge systems?
- What improvements in rules and regulation should be suggested?

Motivation : Accidents and systems

Electronic Chart Display and Information System (ECDIS) MAIB chief inspector: ”the third grounding where watchkeepers’ failure to use ECDIS properly has been identified as one of the causal factors.”

“2014: over 30 manufacturers of ECDIS, each with their own designs of user interface, and little evidence that a common approach is developing."

Case: Collision Aug. 21, 2017-

USS John S. McCain – 10 deaths: Touch screen used in control of speed of the two propellers, ...

Approach and method

Approach:

- Focus on accidents involving onboard electronic bridge systems
- How is the mariners supported by design, organization (manning, training..) and technology

Method:

- Accidents a result of many factors – using Human Factors Analysis and Classification System (HFACS) to get a broad picture
- Literature review of relationship between poor design and accidents, some case reviews
- Interviews of mariners and designers
- Review of 19 accident reports

Sensemaking

Using sensemaking:

- Sensemaking as a dynamic process of observation, orienting and acting; on-going in a social and organisational setting

- To look at the whole system of man, technology and organisational issues

- Accepting that the mariner and actions are a part of a complex setting

Result of general literature review

Relationship between poor design and accidents – general review based on keyword search

- Few general articles – suggestions that a significant part (i.e. 30-50%) of accidents due to poor design
- Reviewed specific analysis - unsafe acts mainly related to decision-making – and preconditions (misuse of instruments)
- Case reviews pointed to poor ergonomics/ deficiency in design; requirements for design should be improved

Results of interviews

Interview regulators, designers, suppliers and seafarers

- Principle of “User driven design” is seldom used - Human factors experts are seldom involved in design or in accident analysis (Norway)

- Accident analysis are often focused on “human error” as a cause (80%?) and not a consequence of the system

- Possibility to learn from practices in aviation (with their ultra high safety) in design, procedures, checklists, training..

Different practices mentioned

Two accident reports - Railways vs Maritime sector published at the same time

- **Railways:** The Åsta accident occurred on January 4th 2000 in Norway. Train collision between two trains resulting in an explosive fire, 19 people were killed. The system were blamed.

- **Maritime:** The Sleipner accident occurred 26 November 1999, where Sleipner collided with a rock. The ship sank and 16 of the people on board died. The captain was sentenced to 6 months in prison.

Accident reports - summary

Review of 19 accident reports - 14 from Marine Accident Investigation Branch (MAIB)

- Poor design (Poor alarms) & poor planning/workload (25)
- Missing/poor regulation/ poor standards (5)

- Loss of situational awareness and sensemaking; poor ability to handle the unexpected - resilience/ redundancy (19)

- Poor training and safety management (13)

Analysis of accident reports

- User driven design missing; simple mechanisms such as alarms are often disturbing the seafarers

- Usability of the bridge systems poor – ability to understand “status at a glace” poor; missing resilience may led to an incident developing into an accident
- Training may be a “stop-gap” measure due to poor design

- Possibility to learn from practices in aviation (with their ultra high safety) in Human Factors focus, design, procedures, checklists, training…

Rules and regulation should support users and the sensemaking perspective

Regulation/practices challenged by economical realities

- IMO/Solas supporting sensemaking in some way but not often practiced in design in the marketplace
- More focus on support of sensemaking by regulators and classification societies

Need to formulate

- industry good practice as rules, to force laggards into line;
- rules in order to raise the standards higher;
- rules when the consequences of failures are significant.

Recommendations

- **User centric design and sensemaking** should be prioritized from industry and regulators - by best practices, by regulation and by inspections

- **System perspective on accidents -**“Human Error” is a consequence – not a root cause – and Human Factors experts must be a part of accident investigations

- **Explore experiences from user centric design** – such as Unified Bridge concepts

- **Continue to adopt best practices from aviation**